

**PETER E. KATZ**  
Plant General Manager  
Calvert Cliffs Nuclear Power Plant

Baltimore Gas and Electric Company  
Calvert Cliffs Nuclear Power Plant  
1650 Calvert Cliffs Parkway  
Lusby, Maryland 20657  
410 495-4101

*A Member of the  
Constellation Energy Group*



February 11, 2000

U.S. Nuclear Regulatory Commission  
Washington, DC 20555

**ATTENTION:** Document Control Desk

**SUBJECT:** Calvert Cliffs Nuclear Power Plant  
Unit No. 1; Docket No. 50-317; License No. DPR 53  
Licensee Event Report 2000-001  
Reactor Trip Due to Motor Generator Local Voltage Adjust Handswitch Failure

The attached report is being sent to you as required under 10 CFR 50.73 guidelines. Should you have questions regarding this report, we will be pleased to discuss them with you.

Very truly yours,

A handwritten signature in black ink that reads "Peter Katz". The signature is written in a cursive style with a large, stylized "P" and "K".

PEK/JKK/bjd

Attachment

cc: R. S. Fleishman, Esquire  
J. E. Silberg, Esquire  
Director, Project Directorate I-1, NRC  
A. W. Dromerick, NRC

H. J. Miller, NRC  
Resident Inspector, NRC  
R. I. McLean, DNR  
J. H. Walter, PSC

FE22

NRC FORM 366 (6-1998)			U.S. NUCLEAR REGULATORY COMMISSION			<b>APPROVED BY OMB NO. 3150-0104    EXPIRES 06/30/2001</b> Estimated burden per response to comply with this mandatory information collection request: 50 hrs. Reported lessons learned are incorporated into the licensing process and fed back to industry. Forward comments regarding burden estimate to the Records Management Branch (T-6 F33), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, and to the Paperwork Reduction Project (3150-0104), Office of Management and Budget, Washington, DC 20503. If an information collection does not display a currently valid OMB control number, the NRC may not conduct or sponsor, and a person is not required to respond to, the information collection.					
<b>LICENSEE EVENT REPORT (LER)</b>  (See reverse for required number of digits/characters for each block)											
<b>FACILITY NAME (1)</b> Calvert Cliffs Nuclear Power Plant, Unit 1						<b>DOCKET NUMBER (2)</b> 050000 317			<b>PAGE (3)</b> 1 OF 05		
<b>TITLE (4)</b> Reactor Trip Due to Motor Generator Local Voltage Adjust Handswitch Failure											
<b>EVENT DATE (5)</b>			<b>LER NUMBER (6)</b>			<b>REPORT DATE (7)</b>			<b>OTHER FACILITIES INVOLVED (8)</b>		
MONTH	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	MONTH	DAY	YEAR	FACILITY NAME	DOCKET NUMBER	
01	14	2000	2000	- 001	- 00	02	11	2000		050000	
									FACILITY NAME	DOCKET NUMBER	
										050000	
<b>OPERATING MODE (9)</b>		1		<b>THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more) (11)</b>							
				20.2201(b)		20.2203(a)(2)(v)		50.73(a)(2)(i)		50.73(a)(2)(viii)	
<b>POWER LEVEL (10)</b>		100		20.2203(a)(1)		20.2203(a)(3)(i)		50.73(a)(2)(ii)		50.73(a)(2)(ix)	
				20.2203(a)(2)(i)		20.2203(a)(3)(ii)		50.73(a)(2)(iii)		73.71	
				20.2203(a)(2)(ii)		20.2203(a)(4)		X 50.73(a)(2)(iv)		OTHER	
				20.2203(a)(2)(iii)		50.36(c)(1)		50.73(a)(2)(v)		Specify in Abstract below or in NRC Form 366A	
				20.2203(a)(2)(iv)		50.36(c)(2)		50.73(a)(2)(vii)			
<b>LICENSEE CONTACT FOR THIS LER (12)</b>											
<b>NAME</b> J. K. Kirkwood						<b>TELEPHONE NUMBER (Include Area Code)</b> 410-495-2013					
<b>COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT (13)</b>											
CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO EPIX		CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO EPIX	
E	AA	HS	G080	Y							
<b>SUPPLEMENTAL REPORT EXPECTED (14)</b>						<b>EXPECTED SUBMISSION DATE (16)</b>		MONTH	DAY	YEAR	
YES (If yes, complete EXPECTED SUBMISSION DATE).						X NO					
<b>ABSTRACT (Limit to 1400 spaces, i.e., approximately 15 single-spaced typewritten lines) (16)</b>											
<p>At 0950 on January 14, 2000, Calvert Cliffs Unit 1 tripped from 100 percent power due to a failure of the No. 11 Motor Generator (MG) Local Voltage Adjust Handswitch. Contacts closed on the handswitch causing No. 11 MG Voltage Regulator to raise the output voltage, increasing the voltage on the reactor trip bus. The output voltage increased to the setpoints of both the Nos. 11 and 12 MG sets' Overvoltage Relays, opening the output contactors of both MG sets. With both MG output contactors open, the reactor trip bus had zero voltage, causing control element assemblies to insert into the core.</p> <p>Operators responded appropriately and primary plant systems functioned as designed. The plant was brought to a safe shutdown condition.</p> <p>Number 11 MG's Local Voltage Adjust Handswitch and Voltage Regulator card was replaced. Both MG sets were meggered, bridged, and load tested. The three remaining voltage control handswitches on Unit 1 were inspected and no wear similar to that of the failed handswitch was found. The unit was restarted January 15, 2000.</p>											

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TEXT (If more space is required, use additional copies of NRC Form 366A) (17)

## I. DESCRIPTION OF EVENT

During normal steady-state operations in Mode 1, Calvert Cliffs Unit 1 tripped from 100 percent power due to failure of the No. 11 Motor Generator (MG) Local Voltage Adjust Handswitch. At the time of the trip, the Unit 1 Reactor Trip Bus was powered by Nos. 11 and 12 MG sets operating in parallel. The reactor trip bus lost voltage and the control element assemblies fell into the core, shutting down the reactor.

The de-energized reactor trip bus tripped the Unit 1 Main Turbine. The main turbine trip generated a reactor trip signal in the Reactor Protective System. All eight reactor trip breakers actuated. The Engineered Safety Feature Systems were not actuated during this event.

Prior to the event, a Nuclear Plant Operator (NPO) entered the Unit 1 27-foot Switchgear Room, where No. 11 MG is located, on normal rounds. The NPO was the last person to enter the room prior to the trip of the reactor. The NPO observed no abnormalities with No. 11 MG and observed the following operating conditions of the MG sets:

## Pre-Event Condition of both MG sets at 09:30 AM

Unit	No. 11 MG	No. 12 MG
Output Voltage	241 VAC	239 VAC
Output Current	32 Amps	62 Amps
Observed condition	Normal	Normal

Both MG sets remained running after the event, and No. 11 MG was abnormally hot to the touch. The Switchgear Room smelled of hot electrical insulation. After the event, responders noted the following operating conditions of the MG sets:

## Post-Event Condition of both MG sets at 10:00 AM

	No. 11 MG	No. 12 MG
Output Voltage	348 VAC	244 VAC
Output Current	0 Amps	0 Amps
Observed condition	Hot	Normal
Overvoltage setpoint (determined later-during troubleshooting)	299.5 VAC	297.6 VAC

The NPO shut off No. 11 MG and continued with post-trip response. The post-trip temperature and voltage of No. 11 MG set indicated the event was initiated by the No. 11 MG set. Although No. 12 MG Output Voltage increased to 297.6 VAC, No. 12 MG returned to its set voltage when the No. 12 MG Output Contactor opened.

After the trip, No. 11 Moisture Separator/Reheater second-stage steam source isolation valve (1-MS-4025) did not close. The open valve increased the cooldown rate of the Reactor Coolant System. Control Room Operators closed

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the main steam isolation valves and used the atmospheric dump valves to control Reactor Coolant System temperature. Within three hours, 1-MS-4025 was shut manually, the main steam isolation valves were opened, and Reactor Coolant System temperature control using turbine bypass valves was resumed.

**II. CAUSE OF EVENT**

The Unit 1 Reactor Trip was caused by the failure of the No. 11 MG Local Voltage Adjust Handswitch. Troubleshooting following the trip discovered a signal to No. 11 MG Voltage Regulator from the No. 11 MG Local Voltage Adjust Handswitch. The handswitch contacts were closed in a "raise voltage" configuration. Investigation revealed the handswitch would change state with minor vibration.

The "raise voltage" contacts in the handswitch are normally closed contacts, the "lower voltage" contacts are normally open contacts. When static the "raise voltage" and the "lower voltage" contacts are both held in the open position by a tapered cam mounted to the back of the handswitch operator. The operator is spring returned to neutral in a static condition.

The contacts are mounted on a sliding plunger which uses spring pressure to force the plunger against the tapered cam. Rotating the operator in the "raise voltage" direction moves the tapered cam allowing spring pressure to slide the plunger, closing the "raise voltage" contacts. Rotating the operator in the "lower voltage" direction moves the tapered cam forcing the plunger against spring pressure, closing the "lower voltage" contacts.

The design of the handswitch was such that in a static condition, with both contacts open, the "raise voltage" contacts were separated by a one millimeter gap. The "lower voltage" contacts were separated by about a ten millimeter gap. Wear of the moving surfaces, and fatigue of the handswitch spring combined to produce sufficient freedom of movement of the "raise voltage" contacts to allow the contacts to connect without handswitch operation.

The NPO that entered the room in which No. 11 MG is located did not operate the handswitch and the security log of the card key on the entry door indicates no one was in the room when the unit trip occurred.

Number 11 MG's Local Voltage Adjust Handswitch changed state, producing a "raise voltage" signal to No. 11 MG Voltage Regulator. The No. 11 MG voltage increased which increased the voltage on the reactor trip bus and on No. 12 MG because of the parallel operation of the two MGs. Number 12 MG Overvoltage Relay opened No. 12 MG's Output Contactor when voltage reached 297.6 VAC, removing No. 12 MG from the reactor trip bus. Number 11 MG Overvoltage Relay opened No. 11 MG's Output Contactor as voltage increased to 299.5 VAC, removing No. 11 MG from the reactor trip bus. With both MG output contactors open, the reactor trip bus had zero voltage causing control element assemblies to fall into the core, shutting the reactor down.



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The de-energized reactor trip bus tripped the Unit 1 Main Turbine. The Main Turbine trip generated a reactor trip signal in the Reactor Protective System. All eight reactor trip breakers actuated. The Engineered Safety Feature Systems were not actuated during this event.

Post-trip troubleshooting found a wire in the motor-operator of 1 MS-4025 had chafed and shorted to ground, tripping the circuit breaker for the motor operator.

### III. ANALYSIS OF EVENT

There was no undue risk to the health and safety of any member of the general public, or risk of exposure to ionizing radiation to any individual from this event. Protective relays and circuit breakers operated as designed, and the unit was brought to a safe shutdown condition without further incident. Operators responded appropriately, and primary plant systems functioned as designed to stabilize the plant.

The open moisture separator/reheater steam source isolation valve resulted in a loss of the normal heat sink and was a distraction to the Control Room Operators responding to the trip, but did not present a safety hazard during the event.

This event is reportable in accordance with 10 CFR 50.73(a)(2)(iv), Any event or condition that resulted in a manual or automatic actuation of any engineered safety feature including the Reactor Protective System.

### IV. CORRECTIVE ACTIONS

- A. Numbers 11 and 12 MG sets were both tested satisfactorily.
- B. The Local Voltage Adjust Handswitch, and the Voltage Regulator for No. 11 MG set were replaced.
- C. Nos. 11 and 12 MG set were satisfactorily load tested.
- D. The remote Voltage Adjust Handswitch for Nos. 11 and 12 MG set, and the Local Voltage Adjust Handswitch for No. 12 MG set were tested. The handswitches were found to operate as designed.
- E. The Local Voltage Adjust Handswitch for No. 22 MG set was tested during a previously scheduled planned maintenance on No. 22 MG set. The handswitch was found to operate as designed.
- F. An Engineering Service Package was issued to replace the voltage adjust handswitches on all four MG sets with improved design handswitches as operating conditions allow.
- G. The motor operator for 1-MS-4025 was repaired.

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V. ADDITIONAL INFORMATION

A. Component Identification

	IEEE 803	IEEE 805
Component	EIIS Function	System ID
Voltage Control Handswitch	HS	AA

B. Previous Similar Events

No other events of this type have occurred at Calvert Cliffs Nuclear Power Plant.